

i A clearer description may be obtained through the following example.

Example:

Starting angle 28° 00' (mean).

Rotate the altitude knob with the initial movement counterclockwise, back and forth between the stops, for 10 cycles and stop the rotation and the averager at 15 seconds (indicated) — read the altitude counter. For this example we will say it reads 28° 4' or has an error of 4' of arc at 15 seconds time (indicated). We know from experience such a large error at 15 seconds will cause greater errors at the 30-second interval. We will attempt to reduce the error in the following manner. Remove the averager from the fixture and loosen the 4 screws holding the eccentric. Place a spanner wrench (TE-5161) in the two holes of the eccentric and move the wrench in one direction, approximately 1/32 inch as measured on the periphery of the eccentric. Tighten the 4 holding screws and attach the averager to the fixture. Retest will show if the eccentric was moved in the right direction. If the errors have increased, remove the mechanism from the fixture and move the eccentric in the opposite direction.

Rewind the instrument and repeat the test.

Starting angle 28° 00'.

Initial Movement CW			Initial Movement CCW		
Indicated		Errors	Indicated		Errors
15	28°03'	+03'	15	28°00'	0
30	28°02'	+02'	30	27°59'	-01'

j. Since the above errors are within the allowable tolerances, the averager may be considered properly adjusted.

k. Rewind the averager. Remove the stop pin and rotate the knob clockwise, then counterclockwise and observe the movement, if any, of the index assembly. This movement should not exceed 0.010 inch through 10 degrees of reading. Adjust the stop screws, as explained previously (see paragraph 2-38), to correct excessive movement. These adjustments are usually minute. The zero on the time dial may move off the zero reference line on the window due to these adjustments. If that is so, remove the mounting plate, loosen the dial screws and reposition the dial.

2-46. DISASSEMBLY.

2-47. DISASSEMBLY OF THE SEXTANT. (See fig-

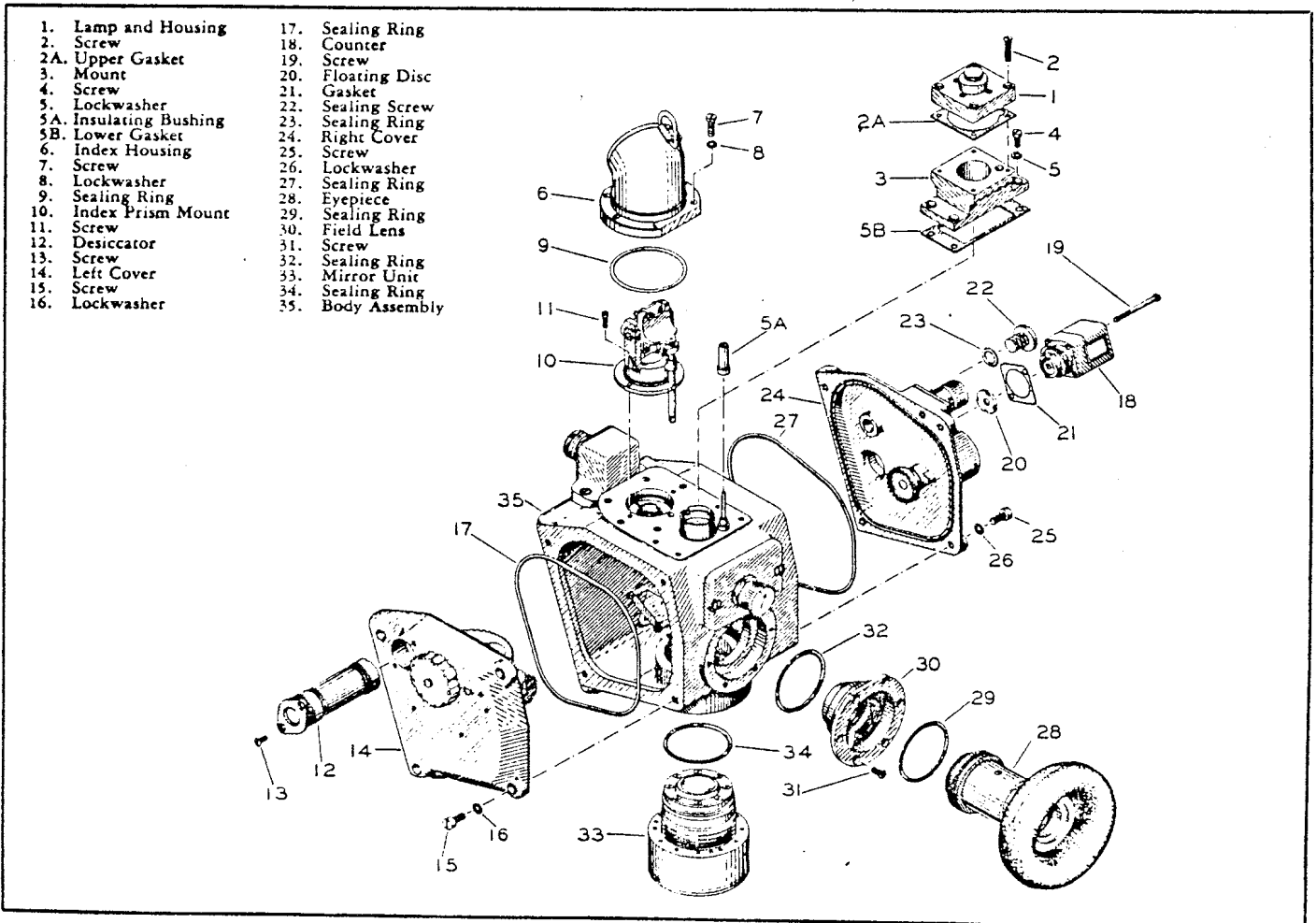


Figure 2-34. Sextant Less Averager

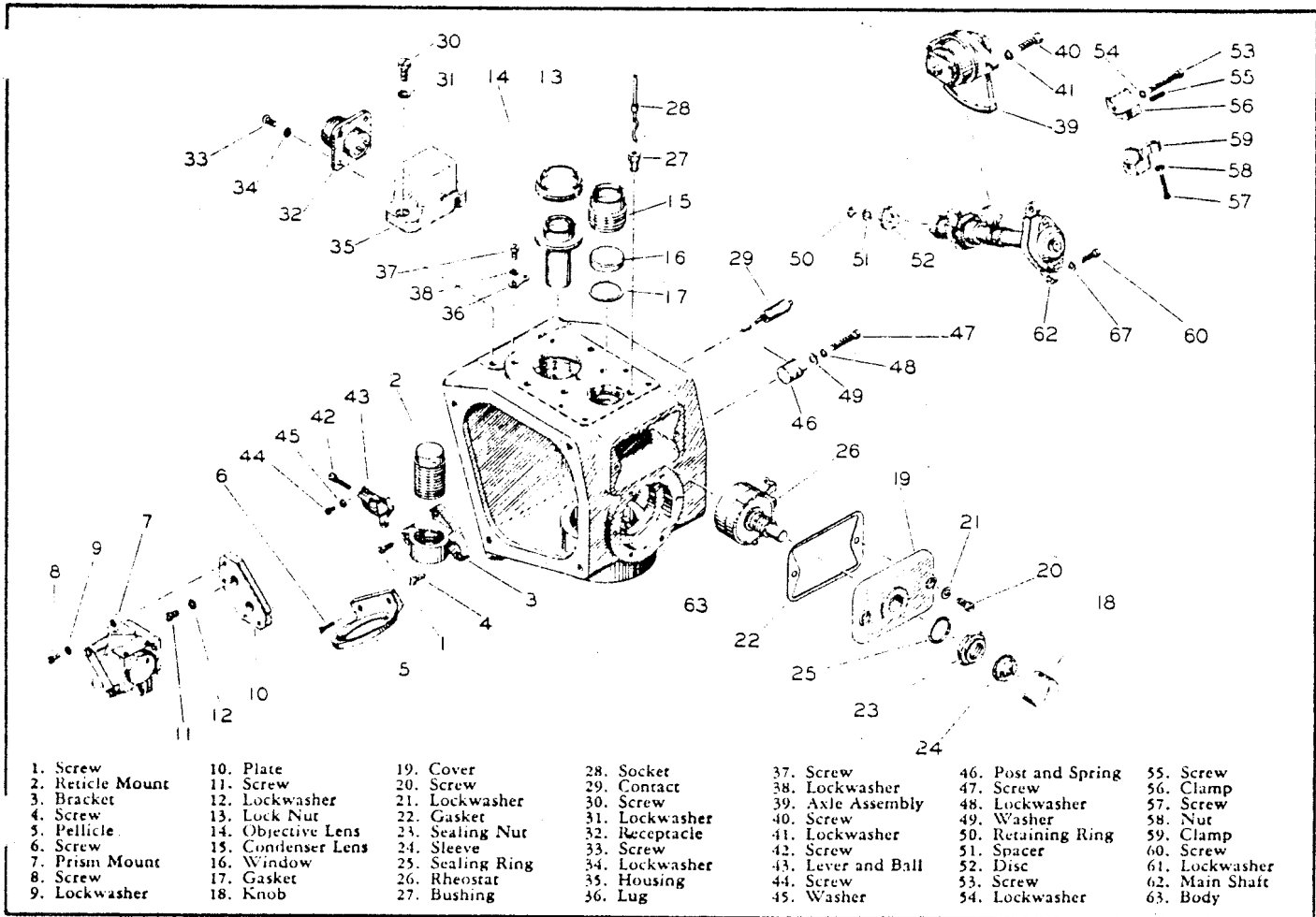


Figure 2-35. Sextant Body

ure 2-34.) Except for attaching parts the disassembly procedures will follow the order of the index numbers assigned to the exploded view.

CAUTION

If care is not exercised during the removal of the left cover assembly, the filter assembly may strike the thin membrane of the pellicle and damage it, necessitating replacement.

CAUTION

A floating disk which is used between the two couplings of the counter and main shaft assemblies may or may not fall out of the assembly when the right cover is removed. In any event the disk must be located and kept with the right cover assembly.

2-48. DISASSEMBLY OF SEXTANT BODY. (See figure 2-35.) Except for attaching parts the disassembly procedures will follow the order of the index numbers assigned to the exploded views.

a. The fixed prism assembly has been adjusted and its setting in the sextant body should not be disturbed unless absolutely necessary.

CAUTION

Exercise extreme care while handling the pellicle (5). Do not touch the membrane as to do so will damage it, necessitating replacement.

b. If it can be avoided do not remove the lever and ball (43) from the axle assembly (39) as to do so will unnecessarily upset the calibration of the sextant.

2-49. CLEANING.

2-50. GENERAL. The lenses and prisms of the sextant have had their light-transmitting surfaces treated with magnesium fluoride to improve the quality of the optical images by reducing reflections and thereby increasing transmission through the optical elements. The recommended procedure for the handling and cleaning of lenses should be adhered to as closely as possible. When handling the optical units, the lenses should always be held by their edges and prisms by the blackened sur-

faces, if possible, as finger marks will stain optical glass. When lenses or prisms are removed from their mounts, they should always be placed on a soft cloth to prevent damage.

2-51. LENSES AND PRISMS. Lens and prism surfaces should be cleaned as follows:

a. Using a vacuum hose, hand blower or camel's hair brush, remove the dust and grit particles.

b. To remove small particles of dust or finger marks, breathe on the lens or prism surface, and then, using a circular motion, wipe the surface with lens tissue or a soft cotton cloth.

CAUTION

Always dust or blow off the lens or prism before wiping the lens, as dust and grit will scratch the surface of the glass and impair the optical quality.

c. If it is necessary to wash the lens or prism, a soap solution or organic solvent such as acetone or grain alcohol may be used.

d. After washing the lens or prism, it should be dried with lens tissue or a soft cotton cloth.

Note

If a component was completely disassembled, all parts (sextant body, optical tubes, lock rings, eyepiece barrel), that are directly related to the optical path or the support of the various lenses and prisms are to be washed with mild, white, bar soap and water to remove all foreign materials. Rinse the parts in clean water and bake dry in an oven 200°C (392°F) for one and one-half hours.

2-52. PELLICLE. To remove dust or lint particles from the thin membrane, a small camel hair brush having long, soft hairs is recommended. If in the opinion of the operator, damage may occur as a result of an attempted removal of certain stubborn particles, it is best that the particles remain rather than risk the damage.

2-53. INSPECTION.

2-54. GENERAL.

- Inspect all leads for insulation breaks.
- All lenses and prisms are to be clean and their magnesium fluoride coating in good condition.
- Pellicle to be free of punctures, stress waves, etc.
- All screws to be reasonably tight.
- Rubber sealing gaskets to be in good condition.
- Adjustment knob to rotate without roughness or binding between -10° and $+92^{\circ}$ as indicated on the altitude counter.
- Silica gel crystals to be dry (blue). If the silica gel crystals are light pink in color they should be replaced.

2-55. REPAIR OR REPLACEMENT.

2-56. DISASSEMBLY OF THE MIRROR UNIT. (See figure 2-36.) Except for attaching parts, disassembly follows the order of the index numbers assigned to the exploded view.

Note

The horizon lens is cemented into the housing. Do not remove unless lens is damaged and replacement is required.

2-57. ASSEMBLY OF THE MIRROR UNIT. Assembly follows the reverse order of the index numbers assigned to the exploded view except for attaching parts. Note procedure below.

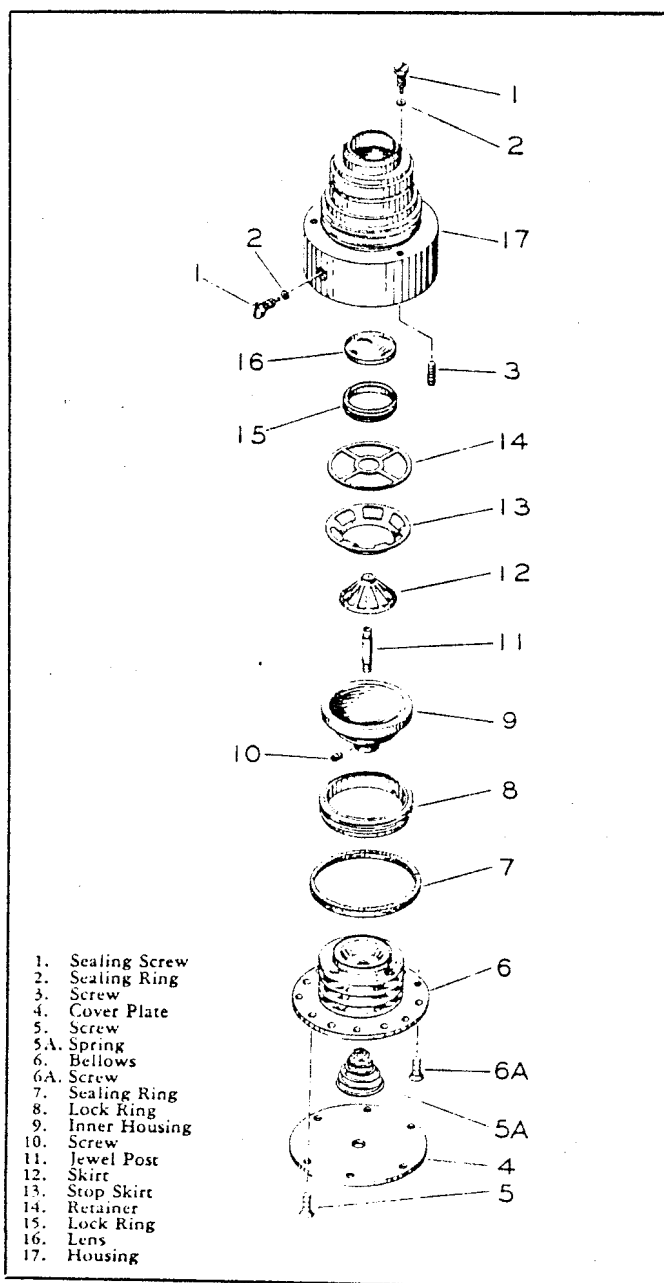


Figure 2-36. Mirror Unit

Note

When replacing cemented lenses first scrape the mounting part clean of cement and wash as per paragraph 2-51. Insert the new lens in the mount and secure with the retaining ring. Using an all-metal syringe and a large gauge needle, insert cement through appropriate hole. Make sure that the cement flows all the way around the groove. Use a dental mirror to check the flow of the cement. The cement will be prepared as follows: mix seven parts by weight of Minnesota Mining and Manufacturing Company's 3M sealer formula EC-1093 to one part of non solvent accelerator EC-1063. This sealer hardens within two hours after mixing. Mix only as much as is needed and use immediately. Be careful not to get the sealer on the lens surface. Wipe the outside surface of the mount clean of excess sealer with cloth moistened with Toluene (Specification JAN-T-171 Amend. No. 2). Bake the assembly in an oven at +70°C (+160°F) for four hours and allow to cool in air.

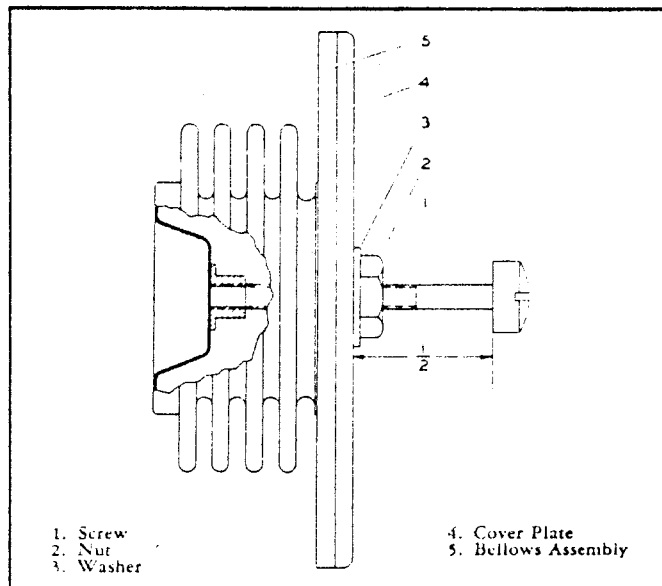


Figure 2-37. Preloading Bellows

- a. After assembly, the bellows must be preloaded in the following manner:
 - b. Obtain a fillister head screw, 3-56 x 1 inch long (AN501-3-16), nut, 3-56 (AN345-3), and plain washer for a size 3 screw (AN960-3).
 - c. Thread the screw into the lug located inside the bellows. Turn down the nut and washer, compressing the bellows until the distance between the cover plate (4, figure 2-37) and the head of the screw is $\frac{1}{2}$ inch. (If the screw is other than one inch long, subtract $\frac{1}{2}$ inch from its length. This then is the desired measurement).
 - d. Deleted.
 - e. Deleted.
 - f. With the sealing screws (1) removed, place the unit in a container filled with silicone fluid DC-200 having a viscosity of five centistokes so that the unit is completely covered by the fluid. The unit should be on its side with the filling hole facing up.
 - g. Place the container with the unit under a bell jar and evacuate to about one inch of mercury absolute (approximately -29 inches gauge pressure at sea level). Leave the unit in the evacuated bell jar for three hours.
 - h. Remove the container and unit from the bell jar, and position and tighten the sealing screws (1) and sealing rings (2) while the unit is still immersed in the fluid.
 - i. Clean the unit with an air hose and check for trapped air by swirling or shaking. Be sure that no bubbles appear beneath the lens when the unit is held upright.

j. If a bubble does appear, replace the unit in the container and bell jar with the lens up. Remove the two sealing screws (1). Evacuate and allow to stand in the vacuum for at least one hour.

k. Repeat steps h, i, and j as often as necessary to remove all the air from the unit.

l. After unit is sealed remove the screw (1, figure 2-37), nut and washer. Clean the unit with an air hose.

2-57A. PELLICLE. If skin of pellicle is wrinkled hold the pellicle above steam vapors of boiling water until the skin tightens which should take about 10 to 15 seconds. After the skin is noticeably tight, rotate the pellicle to accumulate condensation on lowest portion of the frame; then, using a camels hair brush, wipe off excess condensate.

CAUTION

Exercise extreme care while handling the pellicle. Do not touch the membrane as to do so will damage it, necessitating replacement.

2-58. DISASSEMBLY OF THE EYEPIECE. (See figure 2-38.) Disassemble in the order of the index numbers assigned to the exploded view.

2-59. ASSEMBLY OF THE EYEPIECE. Just prior to assembly, wash the eye lens mount, eyepiece mount and the lock rings with mild white bar soap and water to remove any foreign material. Rinse the parts in clean water and bake dry in an oven at 200°C (392°F) for one and one-half hours.

a. Lubricate the outer surface of the lens mount (47) with MIL-G-3278 grease or its equivalent.

b. Place the collective eye lens (49) onto the eyepiece mount (50) and turn the lock ring (48) into the eyepiece mount, securing the lens with reasonable pressure.

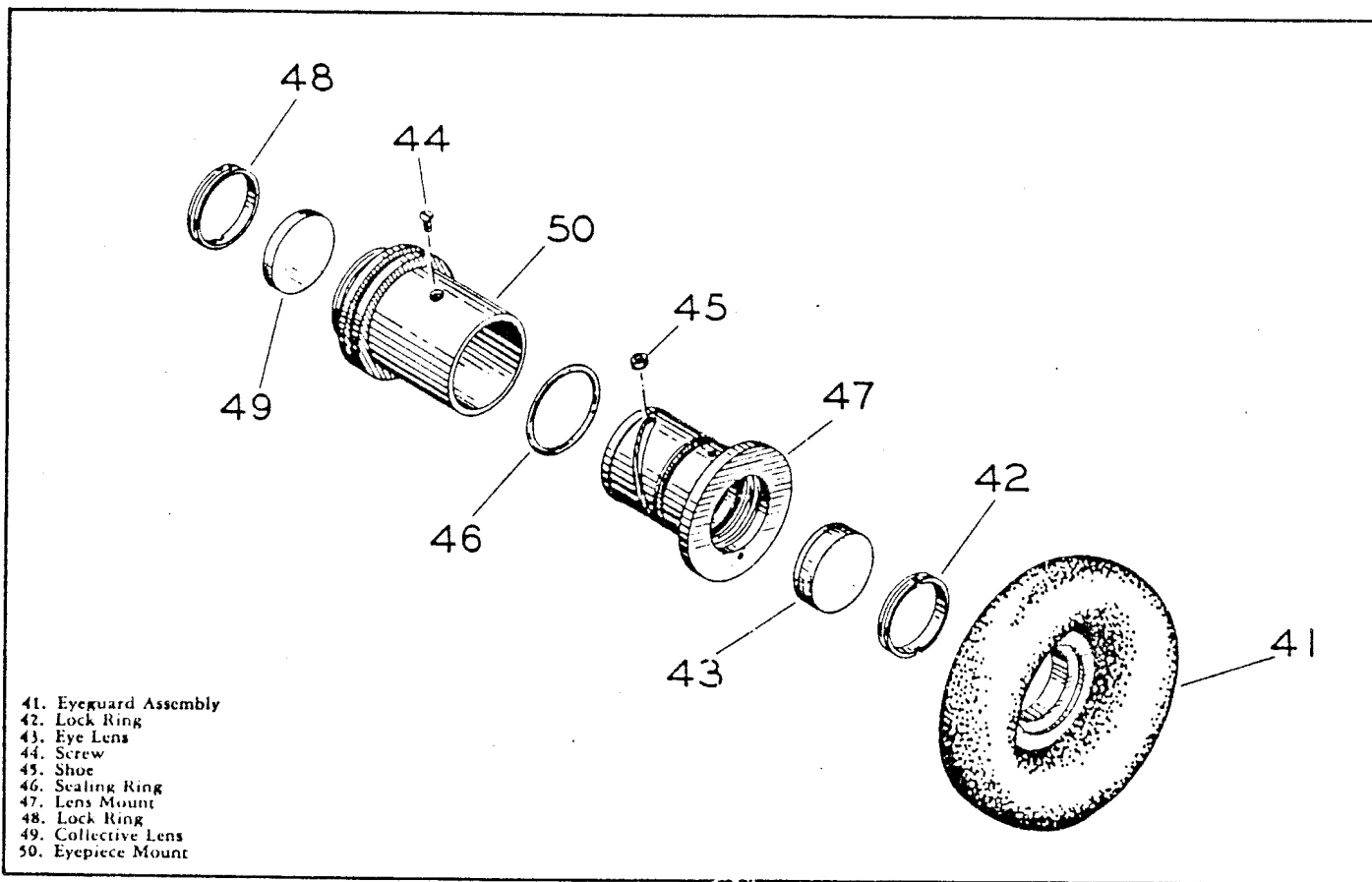


Figure 2-38. Eyepiece Assembly

c. Place the shoe (45), curved side out, into the slot of the lens mount (47). Lubricate and install the sealing ring (46).

d. Insert the eye lens mount into the eyepiece mount. Align the hole in the shoe with the hole in the eyepiece mount and secure the shoe to the eyepiece mount with one flat head screw (44).

e. Place the eye lens (43) on a suitable holding fixture with the crown side up.

f. Place the above assembled eyepiece over the fixture. Turn the assembly over and remove the fixture.

g. Follow the eye lens (43) with a lock ring (42) and make reasonably tight.

h. Screw eyeguard assembly (41) into the eyepiece.

2-60. LAMP HOUSING ASSEMBLY. (See figure 2-39,)

2-61. DISASSEMBLY. Disassembly follows the order of the index numbers assigned to the exploded view except for attaching parts.

2-62. REPAIR.

a. Check the lamp (34). Make sure that the lamp is operative and that the contact areas are clean.

b. Check the wiring for poorly soldered connections and for insulation breaks.

2-63. ASSEMBLY. Assembly follows the reverse order of the index numbers assigned to the exploded view.

2-64. INDEX HOUSING ASSEMBLY. (See figure 2-40.)

2-65. DISASSEMBLY. Disassembly follows the order of the index numbers assigned to the exploded view except for attaching parts and as noted below.

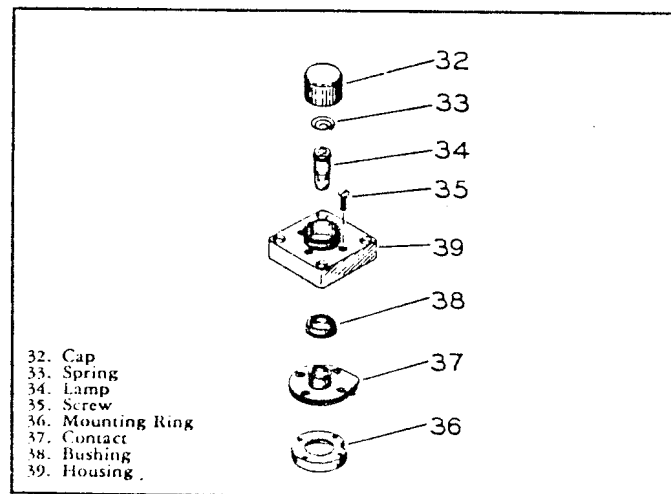
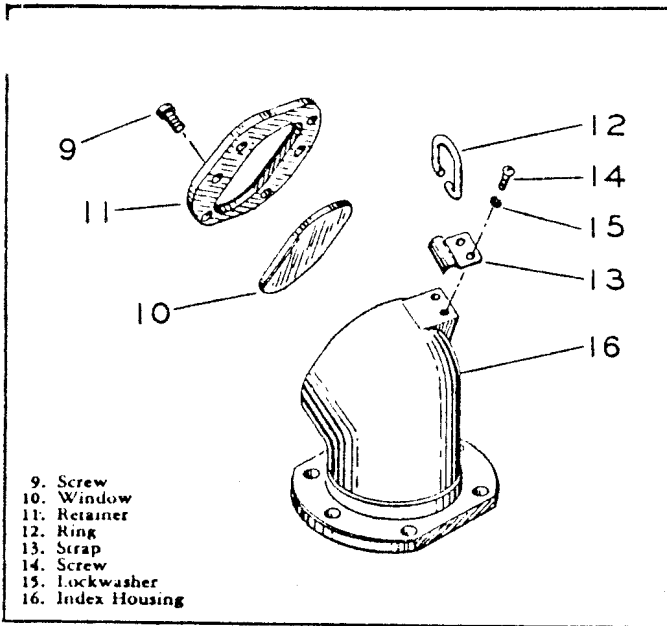


Figure 2-39. Lamp and Housing Assembly

Section II

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Paragraphs 2-65 to 2-67



- 9. Screw
- 10. Window
- 11. Retainer
- 12. Ring
- 13. Scrap
- 14. Screw
- 15. Lockwasher
- 16. Index Housing

Figure 2-40. Index Housing Assembly

a. Check the sealing compound about the window (10). It should feel hard and rubbery. If such is the case do not remove the window (10) from the retainer (11). Simply apply a bead of EC801 around the window edge and then follow procedures d through g in paragraph 2-66. If it feels soft and putty-like the following change should be accomplished.

b. With a sharp pointed tool remove as much of the compound as possible from the window. Lift the window from the retainer (11) and clean it thoroughly with ethylene dichloride.



When using ethylene dichloride, make sure the work is well ventilated.

c. Complete the cleaning as described in the note in paragraph 2-50. All traces of the old sealing compound should be removed from the window (10) and the retainer (11).

2-66. ASSEMBLY. Except for attaching parts, assembly follows the reverse order of the index numbers assigned to the exploded view.

a. The window (10) is cemented in place in the retainer (11) with Minnesota Mining Company's sealer EC801 mixed with EC1063 (See NOTE, paragraph 2-69A).

b. Spread the sealer freely around the inside diameter of the retainer. Make sure that the sealer is continuous around the inside diameter of the retainer.

c. Insert the window in the retainer and work it into the sealer until the glass rests flush against the flange of the retainer.

d. The cement should ooze from around the window rearward toward the mounting surface of the retainer. There must be a ridge of cement extending higher than the mounting surface of the retainer all around the opening. This ridge will provide a seal between the mounting surfaces of the retainer and the index housing (16) after the two are assembled.

e. Assemble the retainer (11) to the index housing (16) and secure with six screws (9).

f. Wipe all excess sealing compound from the window and housing immediately after assembling.

Note

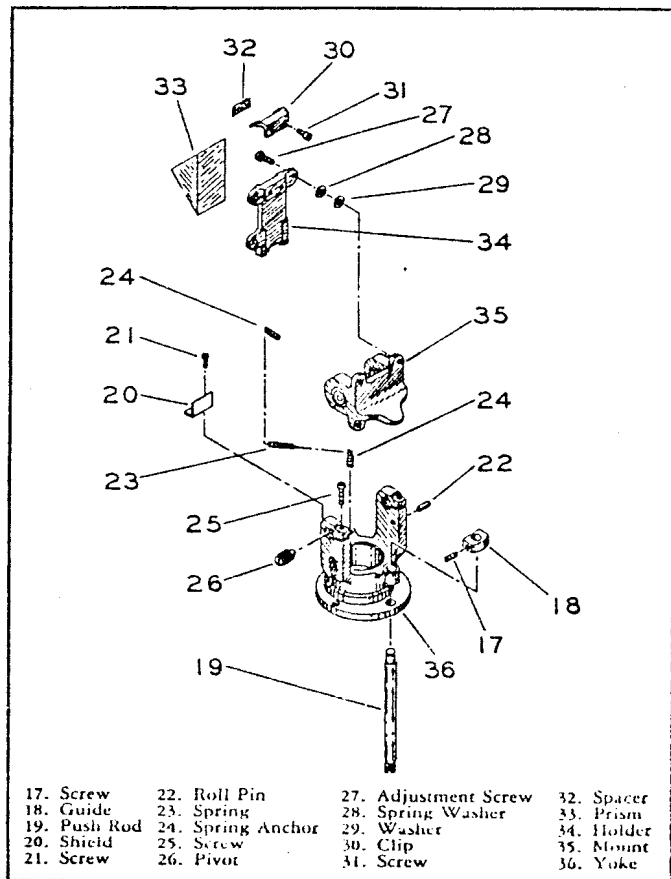
There is no solvent for EC801. Removal of excess should be accomplished immediately, while the compound is in a liquid state.

g. Place the entire index housing assembly (figure 2-40) into an oven and bake at 70°C (158°F) for six hours.



Do not place the entire sextant in the oven, only the index housing assembly.

2-67. INDEX PRISM MOUNT ASSEMBLY. (See figure 2-41.)



- | | | | |
|--------------|-------------------|----------------------|------------|
| 17. Screw | 22. Roll Pin | 27. Adjustment Screw | 32. Spacer |
| 18. Guide | 23. Spring | 28. Spring Washer | 33. Prism |
| 19. Push Rod | 24. Spring Anchor | 29. Washer | 34. Holder |
| 20. Shield | 25. Screw | 30. Clip | 35. Mount |
| 21. Screw | 26. Pivot | 31. Screw | 36. Yoke |

Figure 2-41. Index Prism Mount Assembly

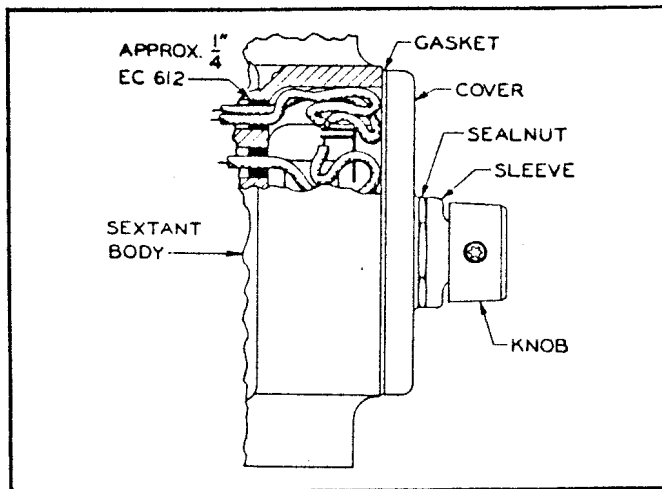


Figure 2-41A. Detail Rheostat Assembly

Note

This assembly requires careful adjustment and should not be disturbed unless replacement or repair of some component is necessary.

2-68. **DISASSEMBLY.** Disassembly follows the order of the index numbers assigned to the exploded view with the exception of attaching parts.

2-69. **ASSEMBLY.** Assembly follows the reverse order of the index numbers assigned to the exploded view.

a. When assembling the holder (34) with the mount (35), tighten the three adjusting screws (27) only to a point where the spring washers (28) are slightly compressed but not flat. Allow room for the adjustment of the assembly.

b. The pivots (26) should fit firmly against the bearing in the prism mount and ball assembly so as to allow free rotation of the assembly without end shake.

2-69A. **SEALING METHOD.** After a number of sextants had been shipped, several alterations were made to further seal the sextant against moisture. These alterations concern the index housing assembly, counter assembly, and rheostat and cover. The changes on the rheostat and cover are described below. The changes on the index housing and counter are described in the text which covers the overhaul of these assemblies. (See paragraphs 2-65, 2-66, 2-84 and 2-93p.) A kit has been assembled to facilitate the above mentioned alterations and is ordered as kit number 10199400010 from Kollsman Instrument Corporation, Elmhurst 73, N. Y. There are two sealing compounds, EC801 and EC612, and one drying accelerator EC1063, for EC801, required to perform the alterations. These compounds and the accelerator are manufactured by the Minnesota Mining Company.

Note

The EC801 must be mixed with EC1063 in a ratio of seven parts EC801 to one part EC1063 prior to application. Only mix sufficient for

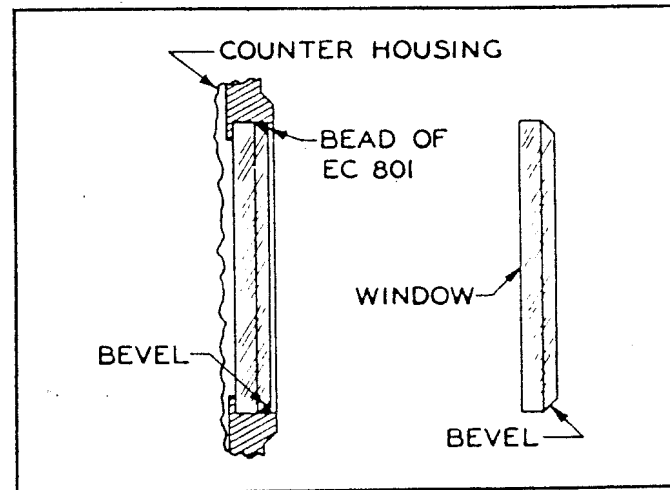


Figure 2-41B. Counter Window Bevel

the immediate use. After approximately three hours the sealer begins to set and is ineffective.

2-69B. **ALTERATION OF RHEOSTAT AND COVER.** (See figure 2-35.)

a. Visually inspect and check to see if the gasket (22), sealing nut (23), sleeve (24) and sealing ring (25), which are parts of the above mentioned kit, are used on the sextant.

Note

Care should be taken to insure that the sealing nut (23) is the same as that depicted in figure 2-35 with a flange for the sleeve (24), on one surface, and a groove for the sealing ring (25), on the other surface.

b. If the above named parts are not present, the following change should be made.

c. Remove the old nut and washer from the rheostat (26). These two parts may be discarded. From kit number 10 19940 0010 select the sealing nut, sealing ring, sleeve, and gasket.

d. Lubricate the contacting surfaces of the sleeve (24) and sealing ring (25) with DC33 and place them into position on the sealing nut (23).

e. Insert the rheostat shaft through the hole provided for it in the cover (19). Place the sealing nut with the sleeve and sealing ring on it, on the shaft and secure the rheostat to the cover.

f. Pack approximately 1/4 inch of EC612 into the holes where the wires enter the sextant body (See figure 2-41A).

g. Place the gasket (22) into position on the cover.

h. Prod the wires into the rheostat cavity and secure the rheostat and cover to the sextant body (63) with the two screws (20) and lockwashers (21).

i. Place the knob (18) on the rheostat shaft allowing a minimum amount of clearance between sleeve (24) and the knob (18) (see figure 2-41A). Secure the knob with a screw.

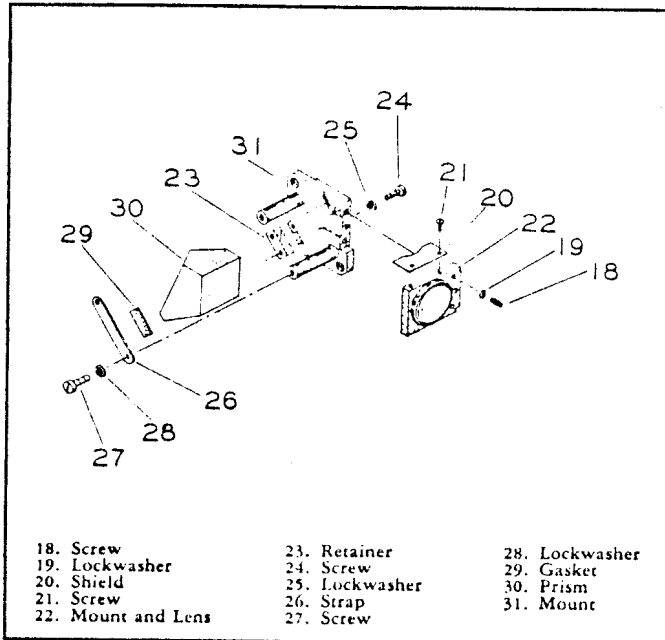


Figure 2-42. Prism and Lens Mount Assembly

2-70. PRISM AND LENS MOUNT ASSEMBLY. (See figure 2-42.)

2-71. DISASSEMBLY. Disassembly follows the order of the index numbers assigned to the exploded view with the exception of attaching parts.

2-72. ASSEMBLY.

a. Assemble parts 20 through 22 forming the third objective lens mount assembly.

b. Assemble this assembly with the mount (31) and secure with three screws (18) and lockwashers (19).

c. Position the prism (30) in this partial assembly so that the 90° corner of the prism (as viewed in profile) fits snugly onto the corner formed by the third objective lens mount and the boss on the prism mount plate. The roof or gable of the prism should then be facing rearward and upward at a 45° angle.

d. Secure the prism in this position with parts 26 through 29.

e. Position the retainer (23) against the prism and secure with two screws (24) and lockwashers (25).

2-73. CONDENSER LENS ASSEMBLY. (See figure 2-43.)

2-74. DISASSEMBLY. Disassembly follows the order of the index numbers assigned to the exploded view.

2-75. ASSEMBLY.

a. The two lenses (2 and 4) in this assembly are identical. They should be positioned on the mount so that the convex surfaces are facing one another and separated by the spacer (3).

b. Assemble in the reverse order of the index numbers assigned to the exploded view.

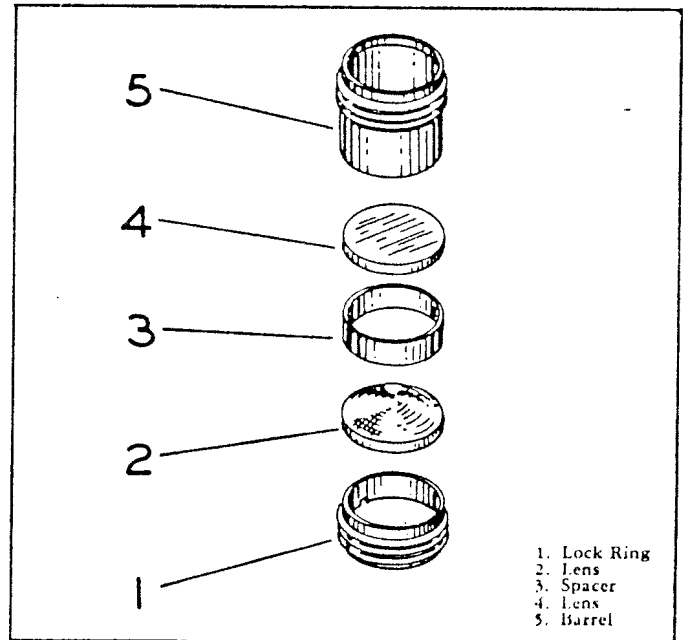


Figure 2-43. Condenser Lens Assembly

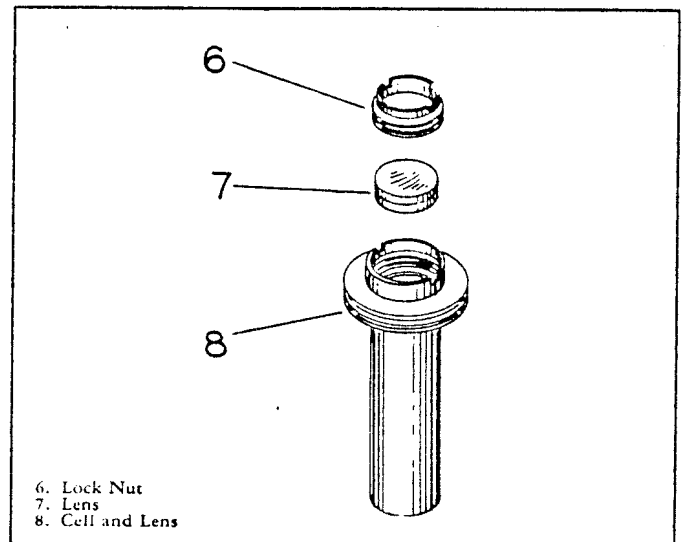


Figure 2-44. Objective Lens Assembly

2-76. OBJECTIVE LENS ASSEMBLY. (See figure 2-44.)

2-77. DISASSEMBLY.

a. This assembly contains two lenses only one of which is replaceable. If the lower lens has been damaged, the whole assembly must be replaced.

b. Before removing the upper lens, mark the top surface as a reference in reassembly.

c. Disassemble in the order of the index numbers assigned to the exploded view.

2-78. ASSEMBLY. Assemble in the reverse order of the index numbers keeping the indicated surface of the lens upward.

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Paragraphs 2-79 to 2-80

2-79. DISASSEMBLY OF THE LEFT COVER ASSEMBLY. (See figure 2-45.) Except for attaching parts the disassembly procedures will follow the order of the index numbers assigned to the exploded view.

2-80. ASSEMBLY OF LEFT COVER. Except for attaching parts the assembly procedures are essentially the reverse of the index numbers assigned to the exploded view.

Note

The lower filter must be positioned with the index knob assembly indicating zero and the clear filter over the opening in the mounting plate.

a. Place the pinion (21) on its shaft (shoulder down) and position it so that the first tooth (between the clear

and the red filters) engages the intermittent gear in the left tooth of the cutout. (See figure 2-46.)

b. When mounting the filter and shutter assembly to the left cover, allow 0.237 inch clearance between the cover mounting surface and the facing surface of the shutter actuating lever. A gauge, such as is shown in figure 2-47 will facilitate this alignment.

Note

Position the upper filter assembly so that the clear filter is above the clear filter of the lower filter assembly and both are over the opening in the mounting plate when the index knob indicates zero.

c. Use washers (7A) as required for 0.001 to 0.006 end play on lever shaft (8).

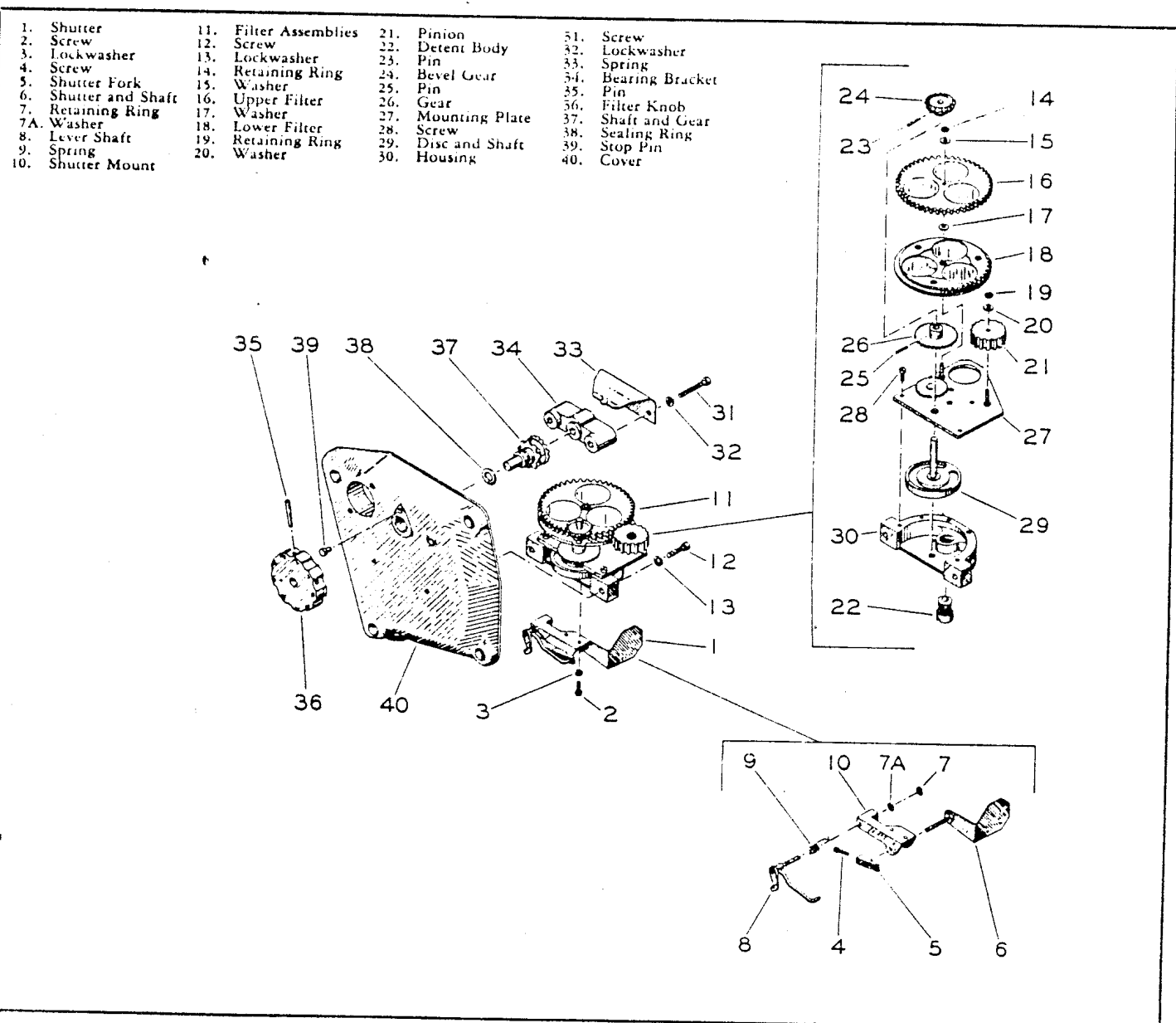


Figure 2-45. Left Cover Assembly

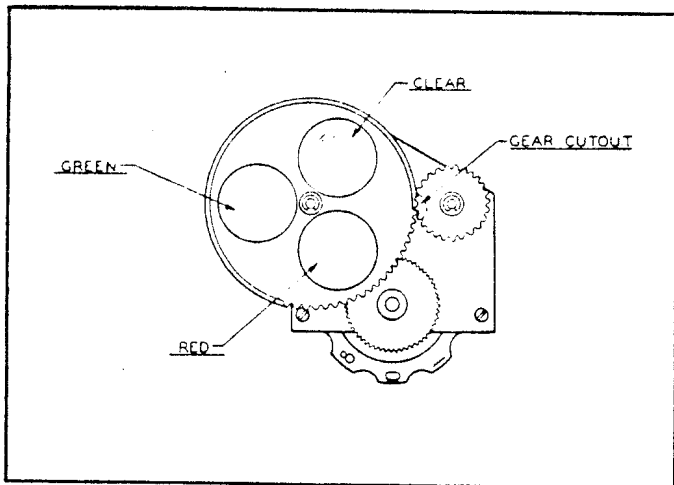


Figure 2-46. Lower Filter and Pinion Assembly

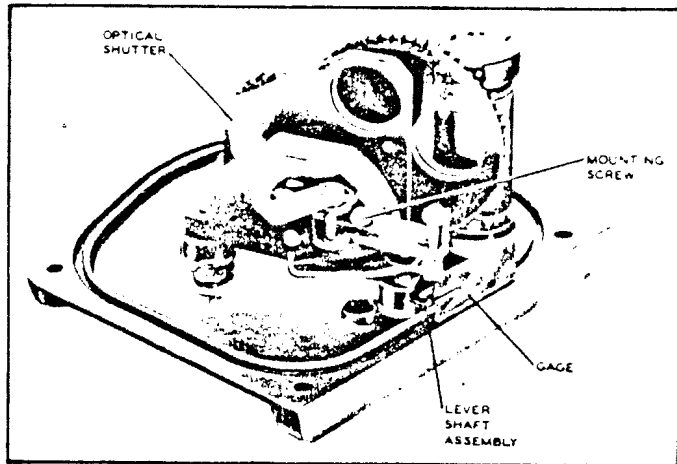


Figure 2-47. Detail—Shutter Actuating Lever

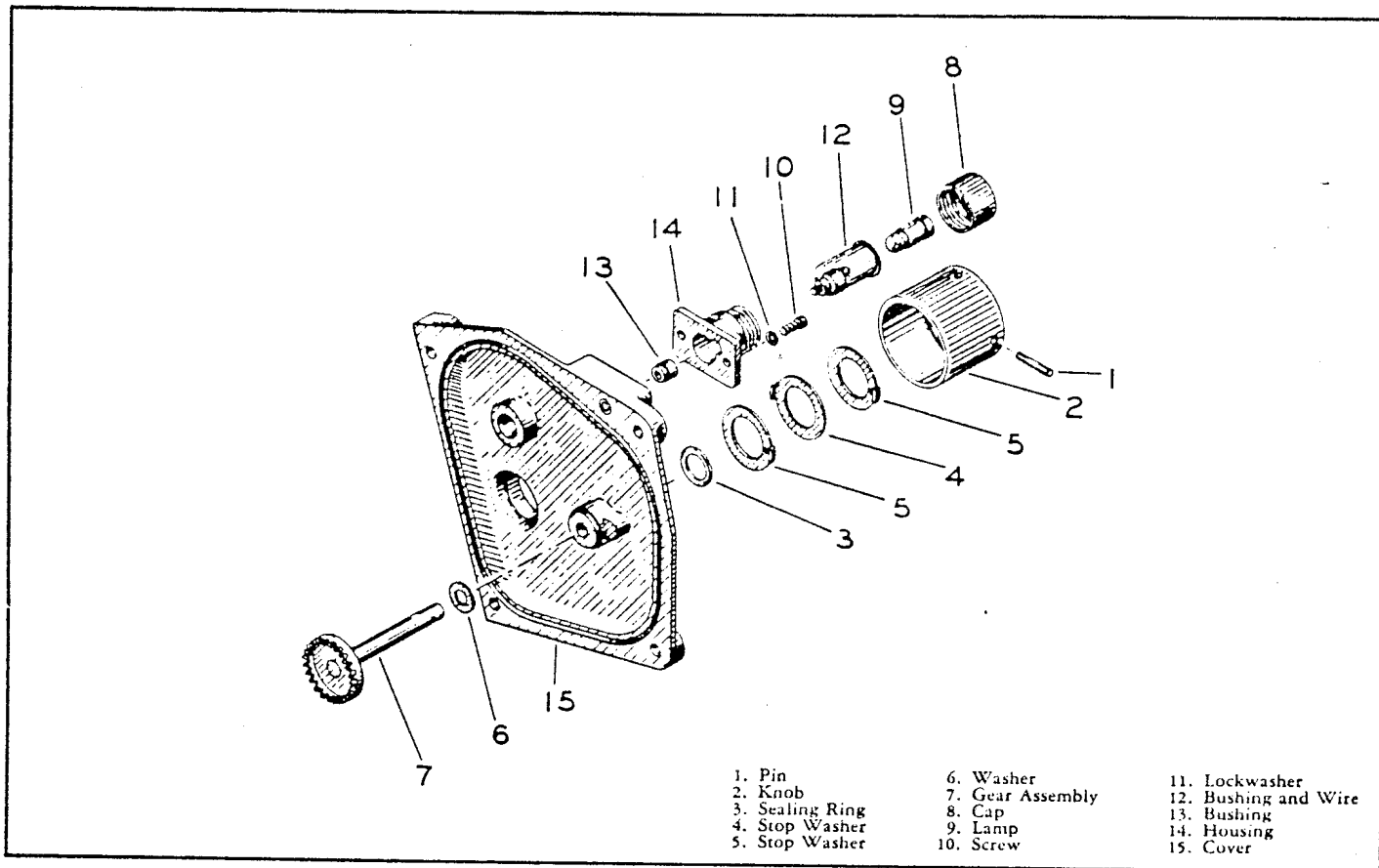


Figure 2-48. Right Cover Assembly

2-81. DISASSEMBLY OF THE RIGHT COVER ASSEMBLY. (See figure 2-48.) Except for attaching parts the disassembly procedures will follow the order of the index numbers assigned to the exploded view.

Note

To ascertain the direction of the taper, position the knob with the taper pin in a horizontal position and the third hole in the knob on top. To remove the pin, drive it from right to left.

2-82. ASSEMBLY OF RIGHT COVER. Except for at-

taching parts the assembly procedures are essentially the reverse of the index numbers assigned to the exploded view.

a. Insert the gear assembly (7) into the bushing. Place one stop washer (5) on the shaft of the gear assembly with the locating pin of the cover assembly in the hole in the washer.

b. Place twenty-three more stop washers (4) in any combination to obtain 0.005 end play of the shaft on top of the above washers with the tabs up and along-

Section II

T.O. 5N10-4-2-3

Paragraphs 2-82 to 2-84

...e each other. Place another stop washer (5) on top of the above washers in the same position.

c. Place the knob and pin assembly on the shaft with the locating pin of the knob assembly in the hole of the top washer. Determine the direction of the taper and secure the parts with a taper pin (1).

d. Rotate the knob in either direction until it stops. When rotated in the opposite direction, from this point, the shaft should revolve approximately $30\frac{3}{4}$ times until it is stopped again. If such is not the case, remove the knob and observe the position of the tabs on the stop washers. They must not be broken and must all face the same direction.

e. Attach the right cover assembly to the sextant housing with two screws, meshing its gear with the gear of the main shaft.

f. Rotate the knob (2). If it binds or turns hard, remove the cover assembly from the sextant housing. Remove the shaft and substitute a thinner thrust washer (6). Reassemble the cover to the sextant housing. The thickness of the thrust washer is determined by the gear mesh. The mesh movement as measured on the periphery of the knob should not exceed 0.003 inch.

2-83. DISASSEMBLY OF THE COUNTER ASSEMBLY. (See figure 2-49.) The disassembly procedures will

follow the order of the index numbers assigned to the exploded view.

Note

Do not disassemble index numbers (24) and

(25) further than indicated. If either part is damaged it must be replaced as an assembly.

2-84. ASSEMBLY OF COUNTER.

a. All shafts and bearing surfaces are lubricated with a moderate amount of a suitable oil (MIL-L-6085A or equivalent).

b. Place the counter drum unit (25) on the gear and bushing (24) so the gears of the drum units are adjacent to the driving gear and bushing assembly.

c. Insert the flange (23) into the drum (22). Align the screw holes in the flange and the drum. Place the drum (22) and flange (23) on the squared end of the shaft so that the 26.5-minute value is aligned between the teeth of the gear and bushing (24). Secure the minute drum on the shaft with the locknut (21). The shoulder of the locknut should be facing out.

Note

The centerline between the teeth of the gear and bushing (23) must be on the 26.5-minute value of the drum (21) within ± 30 minutes of arc. (See figure 2-51.)

d. Tighten the locknut until the screw holes are aligned. Insert and tighten the screw (20).

e. Before replacing the window (18) check to see that all the old cement has been removed from the window and the window contacting surfaces on the rear housing (10) and front housing (16).

f. Visually inspect the window edges. The edges which

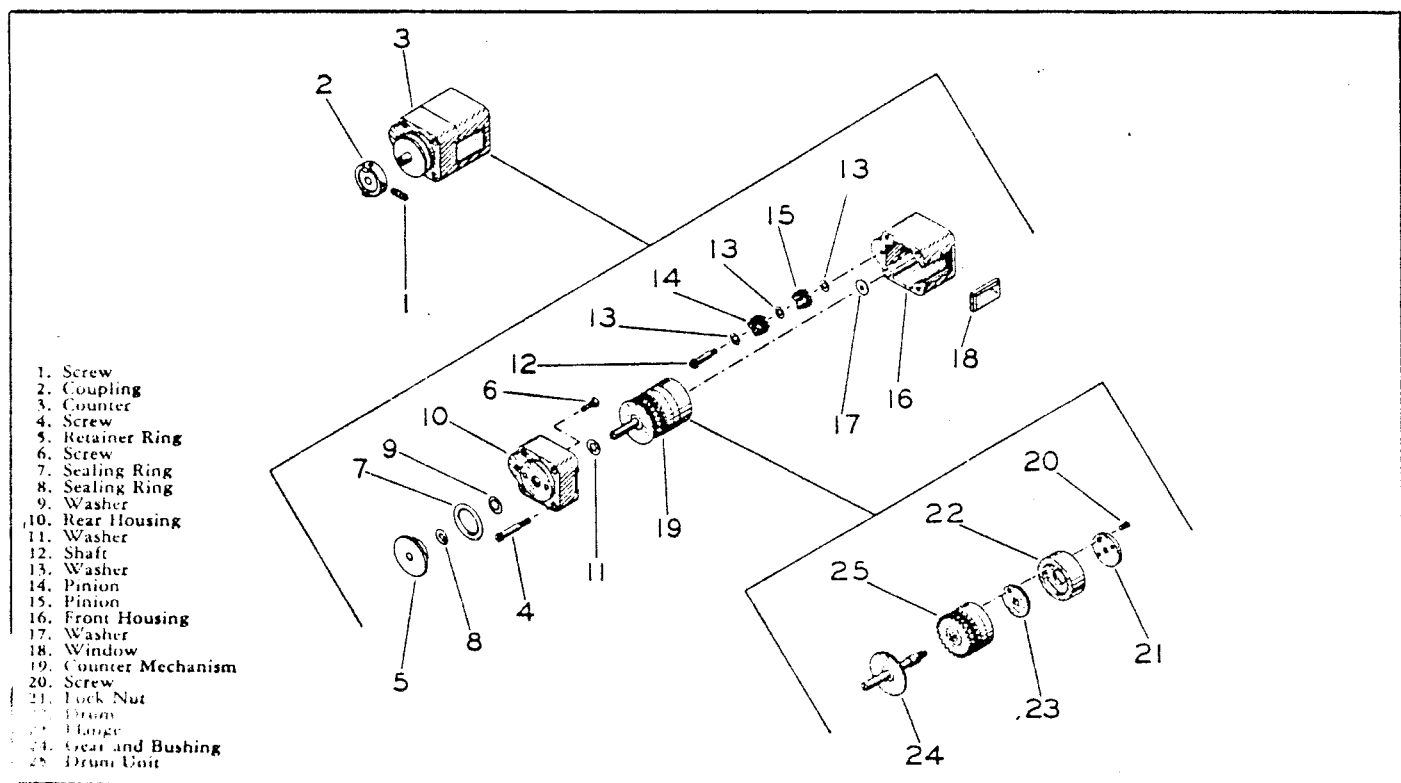


Figure 2-49. Counter Assembly

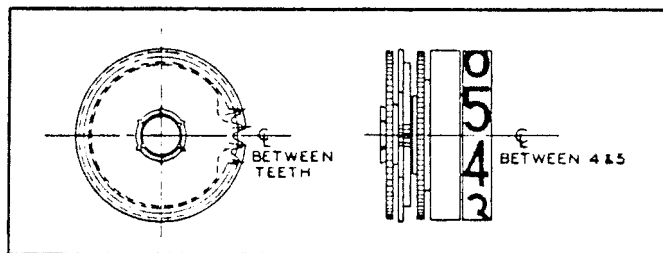


Figure 2-50. Counter Tooth Alignment

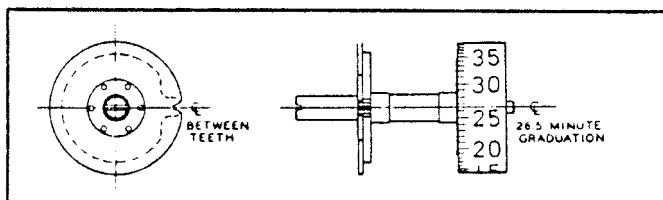


Figure 2-51. Counter Centerline Position

face away from the counter should be slightly beveled as in figure 2-41B. If the window is not beveled a fine file can be used to bevel it.

g. Clean the window thoroughly.

h. Place the washer (11) over the slotted end of the shaft of the counter mechanism (19). Place the front (16) and rear (10) housing and bearing assemblies onto their respective ends of the counter mechanism.

i. Determine by the amount of end play how many washers (17) must be used to limit the end play to 0.003 inch.

j. Remove the rear housing (10).

k. Position the counter drums and the shaft so that the drive teeth are one above the other and are on the centerline between the shaft and the tapped pinion shaft hole.

l. Place a washer (13) over the tapped pinion shaft hole. Place the brass pinion (15) on the above washer so that either of the four full teeth are engaged with the driving gear of the drum unit. Place a washer (13) in the brass pinion gear and engage the full tooth of the steel pinion (14) with the driving gear of gear and bushing (24).

Note

The washers (13) are of different thicknesses and are to be used when and as required to permit satisfactory counter operation.

m. Insert the pinion shaft (12) through the washers (13) and the two pinions (14 and 15). Turn the screw in, securing the parts.

Note

The end play of the pinion gears should be approximately 0.002 inch. Select the washers (13) which will allow this tolerance.

n. Secure retainer ring (5), sealing rings (7 and 8) and washer (9) to rear housing with screw (6).

o. Lightly coat the contacting surfaces of the rear

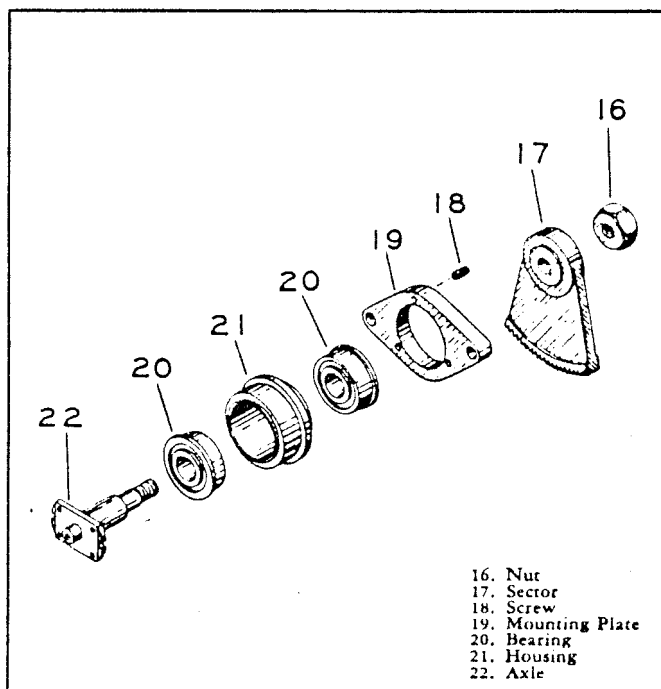


Figure 2-52. Axle and Sector Assembly

(9) and front (15) housings with EC801 mixed with EC1063. (See NOTE, paragraph 2-69A.)

CAUTION

Do not apply EC801 in excess about these surfaces or it will ooze into the counter when the housings are assembled and affect the operation of the counter.

p. Assemble the rear housing (10) and front housing (16). Secure them with two screws (4) and pack the hole over the pinion shaft (12) in the rear housing with EC612. (See paragraph 2-69A.)

q. With bevel facing outward center the window (18) in position in the counter housing. Lay a bead of EC801 around the beveled edge of the window. (See figure 2-41B.) Remove excess as described in paragraph 2-66f.

Note

While waiting for the EC801 to dry cover the cavity in the sextant body with a cardboard cover to prevent moisture and dirt from getting into the sextant.

2-85. DISASSEMBLY OF THE AXLE AND SECTOR ASSEMBLY. (See figure 2-52.) Disassembly procedures will follow the order of the index numbers assigned to the exploded view.

2-86. ASSEMBLY OF THE AXLE AND SECTOR. Items 20, 21 and 22 are hand fitted and the components are not readily interchangeable. If any of these components are defective the assembly consisting of these three pieces must be replaced. All other parts are interchangeable.

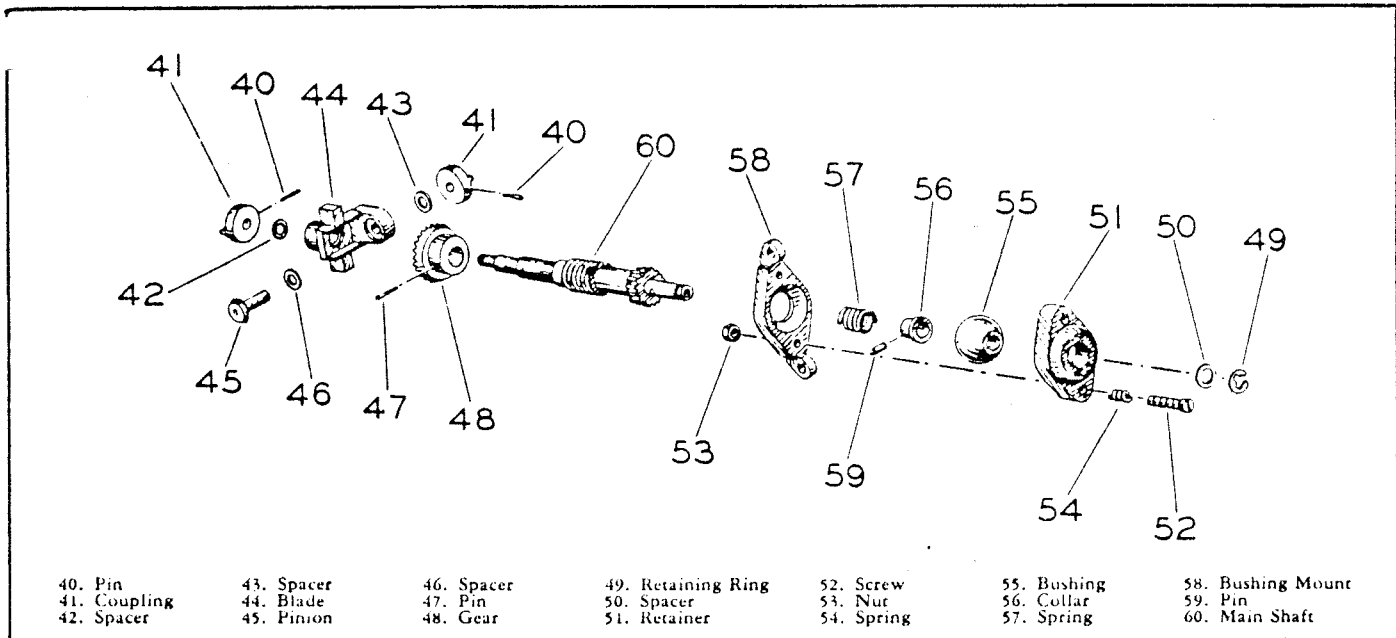


Figure 2-53. Main Shaft Assembly

2-87. DISASSEMBLY OF THE MAIN SHAFT AND PINION ASSEMBLY. (See figure 2-53.) Disassembly procedures will follow the order of the index numbers assigned to the exploded view.

2-88. ASSEMBLY OF THE MAIN SHAFT AND PINION. Assembly procedures are essentially the reverse order of the index numbers assigned to the exploded view.

a. Assemble 40 through 48 to the main shaft (60).

b. Lubricate outer surface of ball bushing (55) with grease (MIL-G-3278). Place it into the bushing mount (58) and hold it in place with the bushing retainer (51). Hold parts together with two screws (52), springs (54) and elastic stop nuts (53).

c. Insert torque rod (TE5791) and adjust spring tension until shaft will fall of its own weight with some drag.

d. Insert main shaft (60) into universal assembly. Install shaft and universal in casting and secure with screws (53 and 60, figure 2-35).

e. Adjust screws (55, figure 2-35) to eliminate up and down play of the shaft but to allow sliding side play.

f. Install and test action of post and spring assembly (46, figure 2-35). Spring must have sufficient force to push bearing block to opposite end of guide.

2-89. FIELD LENS. (See figure 2-54.)

a. Disassembly follows the order of the index number assigned to the exploded view.

Note

The lens (52) is cemented into this unit. Removal is not advised unless the lens is damaged and requires replacement.

b. ASSEMBLY. Assembly follows the reverse order of the index numbers assigned to the exploded view.

Note

After the assembly has been reassembled, the cross hairs must align with the flat edge on the housing as shown in figure 2-55.

2-90. LUBRICATION.

2-91. GENERAL. All lubricants must be applied sparingly; only those parts listed below should be lubricated. (Spec. MIL-G-3278 and MIL-L-6085A.)

a. Ball socket of main shaft (MIL-G-3278).

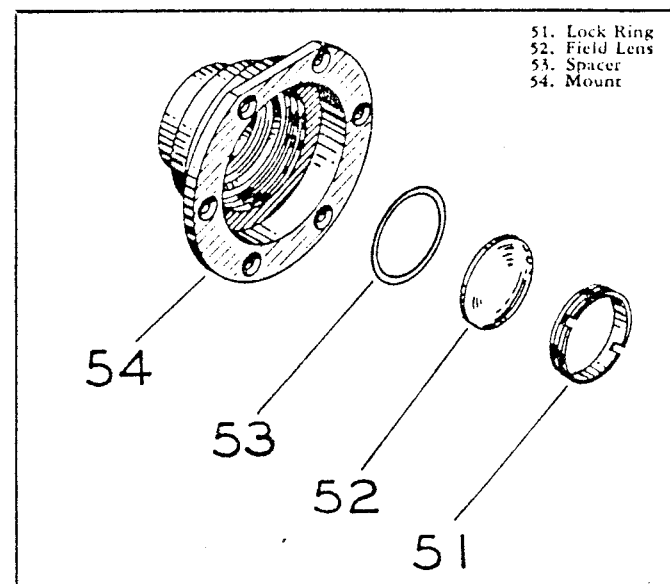


Figure 2-54. Field Lens Assembly

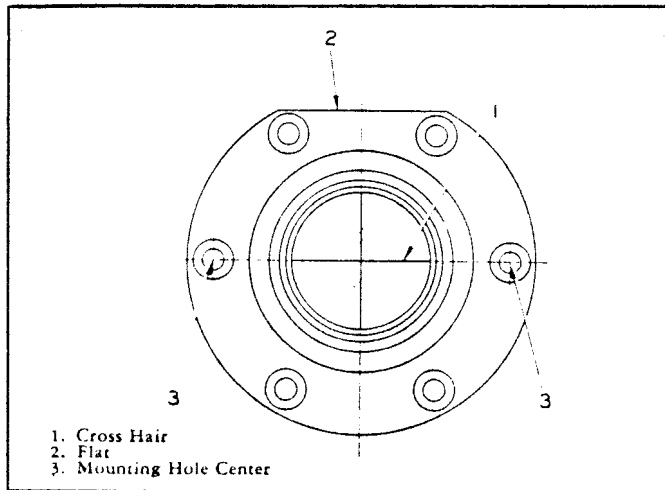


Figure 2-55. Reticle Alignment

- b. Gear, pinion and bearing clamp of main shaft (MIL-G-3278).
- c. Stop washers of right cover (MIL-G-3278).
- d. Shafts of counter assembly (MIL-G-6085A).
- e. Sector and worm gear in main body (MIL-G-3278).

2-92. REASSEMBLY.

2-93. ASSEMBLY OF THE SEXTANT. (See figure 2-35.)

a. Lubricate the legs of the bearing clamp (56 and 59) with MIL-G-3278 grease or equivalent, and secure it to the casting with two screws (57) to eliminate up and down play of the shaft but to allow sliding side play.

b. Guide the axle assembly (39) through the hole in the mechanism body. Align the axle mounting plate with the holes in the casting and secure it with two screws (40) and lockwashers (41).

c. Lubricate the teeth of the sector and the worm on the main shaft with MIL-G-3278 grease or equivalent. Rotate the main shaft until the sector and worm gears have run themselves in and operate smoothly.

Note

If necessary, loosen the adjusting screw (55) and move the main shaft aside to allow the sector to clear it. After the sector is in mesh with the shaft, adjust the position of the screw so that the maximum side play of the shaft when in mesh with the sector is 0.001 inch.

- d. Screw the objective lens (14) into the housing.
- e. Spread a small amount of MIL-G-3278 grease or equivalent on the barrel of the reticle mount (2) and install.
- f. (See figure 2-34.) Mount the field lens (30) to the casting with six flat head screws (31). The reticle should be on the vertical and horizontal axes.
- g. Mount the eyepiece (28) to the casting and tighten with wrench TE5950.

h. Temporarily attach the left cover (14) to the casting with four screws (15).

i. Mount the sextant on the adjustable assembly stand (TE5167) and position it so the left cover assembly is on top.

j. Using a single collimator (TE5998) set at infinity, sight into the objective lens assembly (14, figure 2-35). Loosen the lock ring and adjust the position of the objective lens assembly to obtain sharpest focus of the reticle in the field lens assembly (30, figure 2-34). Secure the objective lens assembly in this position with the lock ring. This adjustment must be made only when the filters of the left cover assembly are in the optical path.

k. Secure the index prism mount assembly (10, figure 2-34) to the body. The push rod must pass freely through the guide on the index prism mount assembly and the matching clearance hole in the body casting.

l. (See figure 2-34.) Position the mount (3) on the casting and secure it with four screws (4) and lockwashers (5). Position and secure the lamp and housing (1) with four screws (2).

m. Position and secure the pellicle (5, figure 2-35) with two screws (6).

n. (See figure 2-34.) Secure the mirror unit (33) into the sextant housing and lock in position with the three stop screws (3, figure 2-36).

CAUTION

Do not screw the mirror unit in too far as it may strike the pellicle.

o. Mount and secure left cover (14) with four screws (15) and lockwashers (16).

CAUTION

If care is not exercised during this installation the filter assembly may strike the thin membrane of the pellicle and damage it.

p. Place the gasket (21) in position on the rear counter housing. Attach the counter to the right cover (24, figure 2-34) with two screws (19) and fill the recesses above the screws with EC612.

q. Before assembling the right cover (24) to the sextant body, adjust the worm and sector assemblies to its mid-point of travel.

r. Set the knob of the right cover assembly to its mid-point of travel which is approximately 10 turns from either stop. Adjust the counter to indicate approximately 45 degrees and align the coupling of the pinion shaft and the coupling on the right cover assembly. Place a floating disk on the coupling of the pinion shaft of the main shaft assembly and mount the right cover (24) on the sextant body with four screws (25) and lockwashers (26). Rotate the altitude knob through its entire range and check the counter indication. The readings should be approximately 92 degrees at one

Paragraphs 2-93 to 2-98

end to minus ten degrees from zero at the other end of the knob travel.

2-94. CALIBRATION OF THE SEXTANT.

2-95. COLLIMATING EQUIPMENT (TE5194D). The three collimating tubes should be mounted on a sturdy, vertical surface and position at 0, 45 and 90 degrees and in a plane parallel to the surface. A Holding Fixture (TE5954) is provided to hold the pivot point of the adjustable prism mount at the intersection of the centerline of the collimating tubes.

2-96. INDEX PRISM LATERAL ERROR ADJUSTMENT. Purpose of test is to check the axis of rotation of the index prism by determining whether the field lens reticle is coincident with the reticle points of the collimators throughout the altitude range of the sextant.

a. Position the sextant in Holding Fixture TE5954 which in turn is secured to Collimator TE5194D.

b. Rotate the altitude knob of the sextant until the vertical collimator is visible through the eyepiece.

c. Position the sextant until the reticle of the sextant field lens and the reticle of the collimator are coincident in this position.

d. Sight into the eyepiece and rotate the altitude knob until the reticles of the 45° and 0° collimators can be compared with the reticle of the field lens. If the reticles at 90° are coincident and at 45° and 0° they have laterally separated, readjust the position of the index prism with the adjustment screws. (See figure 2-56.)

2-97. SEXTANT TILT ADJUSTMENT. (See figure 2-57.)

a. Purpose of Test: Provisions have been made on the artificial horizon to permit its adjustment to keep the objective body and the artificial horizon coincident within 3 minutes of arc when the sextant is displaced fore and aft up to 5° from the vertical position.

b. Align the reticles of the artificial horizon and the field lens with the reticle of any collimator. Swinging the instrument fore and aft approximately 5° either side of the vertical, the artificial horizon should not separate from the reticle of the collimator by more than three minutes. As a guide, assume the width of the long axis of the artificial horizon to be one minute.

c. To accurately determine the amount by which the artificial horizon and the collimator reticle are out of coincidence, read the altitude angle on the counter. Sight into the eyepiece and rotate the altitude knob, bringing the artificial horizon and the reticle in the collimator into coincidence. Read the altitude angle on the counter. The difference will be the error and it should not exceed three minutes.

d. If adjustments are required, remove the four filler head screws and left cover. Loosen screw (1, figure 2-58), rotate the reticle mount (2) one-half revolution at a time clockwise or counterclockwise. The errors

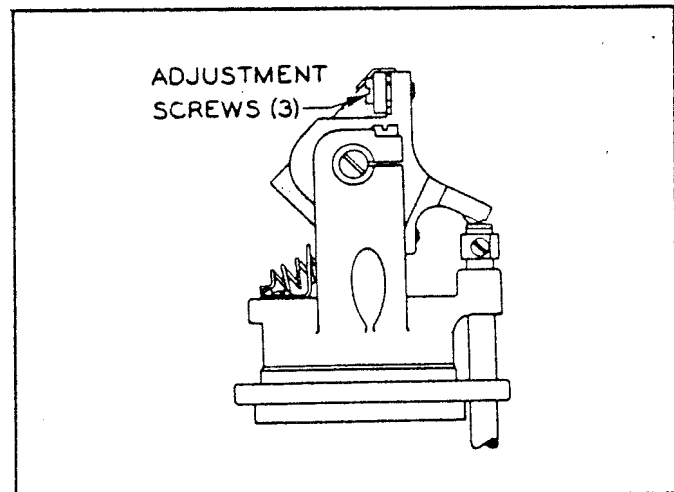


Figure 2-56. Index Prism Adjustment Screws

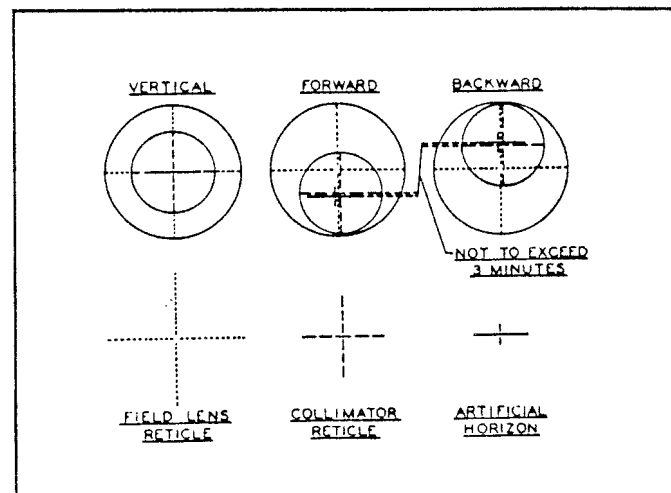


Figure 2-57. Position of Reticle on Tilt Test

are identified as plus errors when the artificial horizon has traveled beyond the collimator reticle. If the artificial horizon should lie between the field lens reticle and the collimator reticle, the error will then be identified as minus.

e. To correct a plus error, turn the reticle mount (2) counterclockwise one-half revolution at a time. The reason for the half revolution is to keep the long leg of the artificial horizon parallel to the horizontal axis of the field lens.

f. To correct a minus error, turn the artificial horizon lens assembly clockwise one-half revolution at a time.

g. When the best possible adjustment has been obtained, secure the assembly in the sextant body. Focus the reticle by adjusting the mirror unit.

2-98. POSITION OF THE INDEX PRISM RELATIVE TO THE ALTITUDE COUNTER. Purpose of test is to determine the error of the angle of the index prism as determined by the collimating equipment and the reading as indicated on the altitude counter.

a. Adjust the position of the sextant so that the horizon reticle and the two reticles (field lens and the 45° position of collimator) are coincident.

b. Observe the counter indication. It should be 45 degrees. If not, remove the counter and position the coupling on the end of the counter shaft to read approximately 45 degrees when the counter is attached to the sextant.

c. Record the readings of the counter when the altitude knob is rotated until the horizon reticle and two reticles are coincident at the zero-degree, 45-degree and 90-degree positions. Assume that the following listing for the three positions is obtained.

Collimator Test Point	Counter Indication
90°	90°0'
45°	45°10'
0°	0°20'

d. In order to make the 45° position zero, it is necessary to subtract 10' from all values, therefore the
 90°0' becomes 89°50' or -10'
 45°10' becomes 45° or 0
 0°20' becomes 0°10' or +10'

e. If we consider the signs of the above derived values, 90 is minus, 45 is zero and 0 is plus. From the table below we can select the adjustment which best suits the instrument.

Test Point	Adjustment A	Adjustment B	Adjustment C	Adjustment D
90	-	+	+	-
45	0	0	0	0
0	-	+	-	+
	lengthen rod	shorten rod	lengthen arm	shorten arm

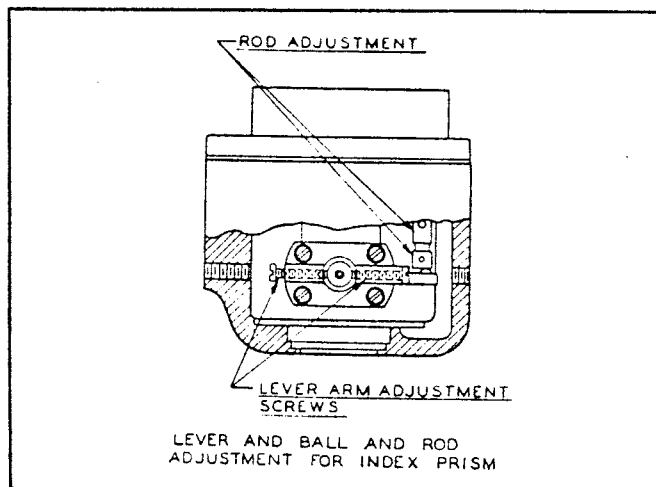


Figure 2-58. Index Prism Adjustment

f. In this particular instance column D is best suited. The corrective step to be taken is indicated in column "D" and figure 2-58 illustrates where the adjustments are to be made. In order to adjust the length of the push rod, a small, pointed tool may be used.

g. Repeat the test until the three positions are within one minute. In the final stages of adjustment the mere tightening of one screw more than the other may be sufficient to correct a small error. Tighten the four fillister head screws in rotation a little at a time. Remove the counter from the cover. Loosen the set screw and position the coupling on the counter shaft to indicate the correct position. The counter should be adjusted to have 10° back movement from zero degrees.

2-99. FINAL ASSEMBLY OF THE SEXTANT.

a. Attach all of the remaining parts to the sextant body.

b. After the averager has been tested and adjusted, position it on the completed sextant so that the coupling on the main shaft of the sextant is engaged with the mating coupling of the averager. Secure the averager to the sextant with four fillister head screws.

c. Use care when replacing the averager to be sure that the shutter actuating push rod in the averager aligns exactly with the shutter-actuating lever protruding from the rear of the left cover. The mounting screw clearance holes in the averager are oversized and will permit this adjustment.

2-100. FILLING THE SEXTANT WITH 'DRY NITROGEN. After each overhaul the inner chambers of the sextant must be evacuated and filled with dry nitrogen. Examine the silica gel of the desiccator to determine the extent of the moisture content in the tube. If the top layer of the silica gel crystals has turned pink and the balance of the crystals are blue, it is only necessary to replace the desiccator with a new one. However, if condensate is visible in the optical system or if the silica gel crystals of the left cover assembly indi-

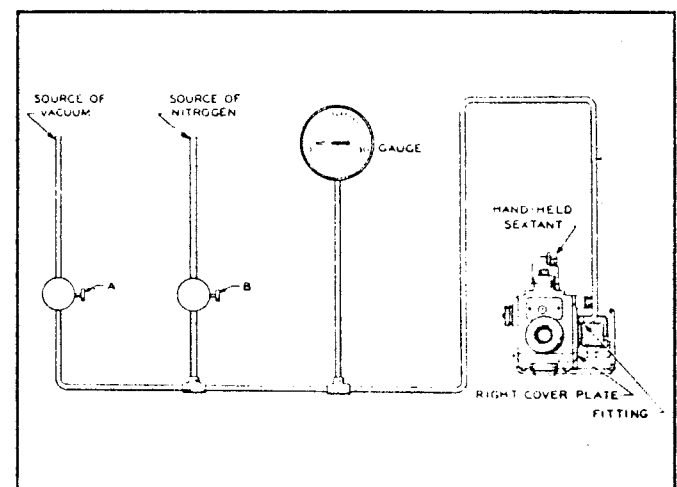


Figure 2-59. Filling with Dry Nitrogen

icates moisture content, the sextant must be filled with dry nitrogen and sealed. The procedure is as follows.

a. Remove the sealing screw assembly in the right cover of the sextant and insert a suitable fitting in its place. Connect brass or copper tubing to the fitting and to tees, valves, a gauge and sources of vacuum and dry nitrogen as indicated in figure 2-59. The pressure at the source of nitrogen should be between 15 and 25 psi.

CAUTION

Be sure that no dirt, grease or other foreign matter is present in the system. Do not use rubber tubing.

b. Open valve A. When the gauge indicates 30 in. Hg (vacuum), close valve A and observe gauge for a one-minute period. If the gauge indication falls during this period, a leak in the sextant is evident. If a leak is indicated, check all gaskets on the sextant. Replace gaskets as required.

c. If the reading on the gauge remains constant, open valve A and apply vacuum to the sextant for a period of 15 minutes.

d. Then close valve A and open valve B very slightly allowing nitrogen to fill the sextant very slowly until gauge reads zero in. Hg.

Note

The needle on the gauge should travel from 30 to zero in. Hg in approximately one minute.

e. Close valve B. Allow the nitrogen to remain in the sextant for five minutes. Care should be taken not to let the pressure of nitrogen within the sextant exceed 15 psi above atmospheric pressure.

f. At the end of the five-minute period, open valve A and evacuate the sextant for 15 minutes.

g. At end of the 15-minute period repeat the procedure described in steps d and e above.

h. Repeat step f above.

i. At the end of the 15-minute period, refill the sextant with nitrogen for five minutes. Then remove the fitting from the sextant and insert screw and washer as quickly as possible to prevent the entrance of moist air.

Note

On occasion, drying the sextant may be accomplished by the repeated replacement of the silica gel indicator.

2-101. INTERNAL WIRING. Internal wiring of the sextant is schematically illustrated in figure 2-60.

2-102. CARRYING CASE ASSEMBLY. Examine the case for evidence of deterioration or loose fitting parts. All rubber nests, bumpers and gaskets should be securely cemented in place with Armstrong's Cement D236, manufactured by the Armstrong Cork Co., N. Y. C. All damaged parts should be replaced.

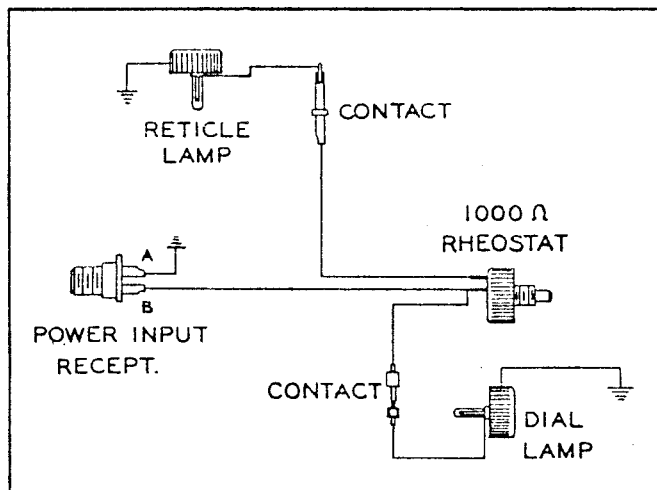


Figure 2-60. Wiring Diagram

**SECTION III
TEST PROCEDURE**

3-1. TEST PROCEDURES.

3-2. GENERAL. Each sextant shall be subjected to the following tests in the following order.

3-3. EXAMINATION OF PRODUCT. Each sextant and case shall be inspected to determine conformance with this specification with respect to materials, workmanship and envelope.

3-4. REMEDIAL ACTION. Replace all burred screws or damaged parts. Retouch imperfect paint with dull black lacquer.

3-5. SCALE ERROR. Each sextant shall be tested for scale error at five points: minus 1, 0, 1, 45, and 90 degrees of angular altitude with the horizon reference line centered on the cross hairs, or at any other points selected at the discretion of the testing agency with both increasing and decreasing readings. The permissible error at any point is two minutes of arc. Lateral displacement of the reference centers shall not exceed five minutes of arc.

3-6. REMEDIAL ACTION. If there are excessive errors in altitude, the sextant may be adjusted as described in

paragraph 2-98. If there is excessive lateral displacement, refer to paragraph 2-96.

3-7. SHADE GLASS. Each sextant shall be tested to determine the error due to the shade glasses. The use of any shade glass shall not introduce secondary images in the line of sight or cause a change in the altitude reading of more than 30 seconds.

3-8. REMEDIAL ACTION. In the event of failure of this test, replace the defective filter assembly.

3-9. FOREIGN PARTICLES. Foreign particles in the field of view shall be counted and weighed as described below.

Size (in inches)	Count
below 0.0004	1
0.0004 to 0.001	4
0.001 to 0.004	10

a. Particle size may be estimated by comparison to the etched reticle lines which are 0.0008 inch wide.

b. In a five-degree field surrounding the center of the field of view, the total weighted count shall not exceed eight.

c. The remainder of the field of view shall not exceed a total weighted count of 30.

d. The areas described can be estimated by comparison with the total field which is 15 degrees.

3-10. REMEDIAL ACTION. Disassemble the sextant and clean the component or components that contain the particles.

3-11. SLIPPAGE. The averager shall be operated for the maximum possible time interval and the altitude setting noted after bringing the indices into coincidence. Without rewinding the mechanism, the knob shall be rapidly oscillated 5 degrees from its setting. After a minimum of five cycles, the indicator shall be brought into coincidence. The altitude setting then obtained from the averager shall not differ from that previously obtained by more than two minutes of arc. To eliminate the effect of backlash from this test, both altitude readings shall be obtained as the primary element of the averaging indicator is brought into alignment by rotation of the knob in the same direction as that of the start of the cycles. This test may be combined with other tests if desired.

3-12. REMEDIAL ACTION. Adjust spring tension of averager as described in paragraphs 2-40 and 2-41.

3-13. MULTIPLE SETTING. With the altitude setting at some chosen value, the averager shall be prepared for operation. The averager shall be operated for its minimum period (about 30 seconds) and stopped. The altitude and time shall be noted. The altitude setting shall be changed by any amount up to 4 degrees, but not less than 10 minutes. The averager shall be operated for a period of 15 seconds and stopped. The altitude and time shall again be noted. This procedure shall be repeated changing altitude at random, both increasing and de-

creasing, to utilize full running time of the averager. The sum of the products of each altitude by its time of operation divided by the total time shall equal the averager altitude as computed by the averager to within ± 2 minutes of arc. This test shall be performed five times using different ranges of altitude and at least two tests shall involve radically different times of entry.

3-14. REMEDIAL ACTION. If the unit fails this test the averager must be adjusted as described in paragraph 2-45.

3-15. VARIABLE TIME AVERAGER (VTA)—ZERO ADJUSTMENT. After the instrument has been rewound, and before the averaging mechanism is put into operation, oscillation of the knob through 10 degrees range of reading shall not move the element of the averaging indicator by more than 0.010 inch for a series of five or more cycles.

3-16. REMEDIAL ACTION. Adjust averager as described in paragraphs 2-44 and 2-45.

3-17. VARIABLE TIME AVERAGER (VTA)—ZERO SETTING. After the averaging device has operated for a complete cycle of operation, it shall be rewound. When rewound, the indicator shall return to within ± 0.010 inch of its zero index mark.

3-18. REMEDIAL ACTION. Check for sticky index disks of the Yoke and Index Assembly. See paragraph 2-12 to 2-15.

3-19. VARIABLE TIME AVERAGER (VTA)—BACKLASH IN AVERAGING MECHANISM. After the instrument has run for the maximum time interval and before it is rewound, backlash in the averaging mechanism shall be determined by bringing the indicating elements and the index marker into coincidence first from one direction then from the opposite direction and noting the resultant sextant altitude readings. These readings shall not differ by more than 1 minute. To eliminate the effect of slippage, all operations of this test shall be done slowly.

3-20. REMEDIAL ACTION. Check all meshing gears, check side play of ball carriage. Check spring tensions as described in paragraphs 2-40 and 2-41.

3-21. MAXIMUM OPERATING PERIOD. The averager shall be operated three times for the maximum time interval. The length of time of each such period shall be 1 minute ± 2 seconds. This test may be combined with other tests if desired.

3-22. REMEDIAL ACTION. Adjust clock mechanism in averager. Adjust the control unit as described in paragraph 2-38.

3-23. SEXTANT CASE. The sextant case shall be inspected for signs of any form of deterioration or loose fitting components which would make it unfit for normal use.

3-24. REMEDIAL ACTION. Cement all loose parts or replace damaged parts.

**SECTION IV
DIFFERENCE DATA INDEX**

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1972B-02

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Note

Overhaul and Test Procedures for the model included in this section are the same as procedures for type 1972-02 except for the specific differences noted by the applicable Difference Data Sheet. Sections II and III contain complete Overhaul and Test Procedure Information.

HANDHELD AIRCRAFT SEXTANT**KOLLSMAN TYPE 1972B-02**

THE INSTRUCTIONS CONTAINED IN PRECEDING SECTIONS OF THIS HANDBOOK APPLY, EXCEPT FOR THE SPECIFIC DIFFERENCES LISTED IN THIS DATA SHEET.

LEADING PARTICULARS

ALTITUDE: -10° to $+92^{\circ}$

VOLTAGE: 28 volts

CONTROL: One knob, 5° per revolution

SEALING: Sealed against moisture and fungus

OVERHAUL TOOLS REQUIRED: Same as for type 1972-02.

DISASSEMBLY: Same as for type 1972-02 except that the prism mount (7, figure 2-35) in the Sextant Body is secured by a flat head screw. There is no lockwasher (9) and no sealing ring (25).

CLEANING: Same as for type 1972-02.

INSPECTION: Same as for type 1972-02.

REPAIR OR REPLACEMENT: Same as for type 1972-02 with the following exceptions:

- a. The mirror unit uses mirror fluid DC200 having a viscosity of 7 centistokes.
- b. The eyepiece assembly, figure 2-38, contains an additional sealing ring on the lens mount and a new lens mount, allowing finer adjustment.
- c. The prism and lens mount assembly contains a new mount (31, figure 2-42), and a new mount and lens (22) which is now secured by two screws (18) and lockwashers (19).

LUBRICATION: Same as for type 1972-02.

REASSEMBLY: Same as for type 1972-02.

INTERNAL WIRING: Same as for type 1972-02 (figure 2-60) except that the rheostat has a 1700 ohm value.